UNIVERSITY OF CALIFORNIA COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION
BERKELEY 4, CALIFORNIA

A HOMEMADE BALE LOADER[1]

J. S. WINTERS[2] AND J. P. FAIRBANK[3]

Windrow pickup hay balers enable hay growers and feeders to save labor. Another work-saving device is a machine that picks up and elevates to a point above the truck bed the bales that are scattered over the field by the baler.

Because of the shortage of critical materials, new manufactured bale loaders are now scarce. This leaflet describes a homemade loader[4] developed by the Division of Agricultural Engineering, University of California. Constructed

Fig. 1.--Loader attached to a truck, with a bale entering the chute.

Fig. 2.--Loader attached to a wagon.

mainly from noncritical materials and old automobile parts, it can be built by farmers or by others who have access to a welding outfit and a lathe.

The loader is ground-driven. The drive is made from two old automobile rear axles. A Ford V-8 rear axle carries the loader and drives a countershaft made up from parts of a Ford model A rear axle. These axles were selected because the torque tube and radius rods of the V-8 make a simple and rugged support for the countershaft, bale chute, and platform. Furthermore, these two readily available axles can be combined with a minimum of shopwork. The bale chute and platform are made of wood; the hitch bars and all braces, from standard black pipe.

The accompanying photographs and the drawings illustrate the various parts and show how they are assembled to make a traction-driven bale loader that slides the bales up a chute by means of a single chain (figs. 1 and 2).

The following instructions may aid in constructing this bale loader. First check the list of materials and see that everything needed is at hand or can be obtained.

Countershaft Assembly

Completely dismantle the model A Ford rear axle; discard the axle shafts, differential spider, and bevel pinions. Machine a countershaft according to dimensions given in figure 3, and weld it into one half of the differential case as shown at A, figure 4. Cut axle housings from the differential housing at the welds (see A, fig. 5). Machine two 1/2-inch plates to fit into the openings on the differential housing where the axle housings were cut away. Weld a bracket to one plate as shown at B, figure 5. Bore the other plate to a loose fit for a 1-1/4-inch shaft; then counterbore it to take a no. 50049 National grease retainer (fig. 6). Leave the grease retainer out until the final assembling; otherwise it might be damaged. Weld both plates into place (see A, fig. 5). Assemble the master gear, differential case, countershaft, and differential housing. Install the master gear in the differential case so that it will

[1]Revised, March, 1944; this supersedes the publication issued in July, 1943. The present leaflet describes simplifications and improvements developed by a year's use of the loader in the field.

[2]Associate in Agricultural Engineering.

[3]Extension Specialist in Agricultural Engineering.

[4]Investigation has not revealed any patent which this device would infringe. The University of California assumes no responsibility in this respect, however, if the situation proves to be otherwise.

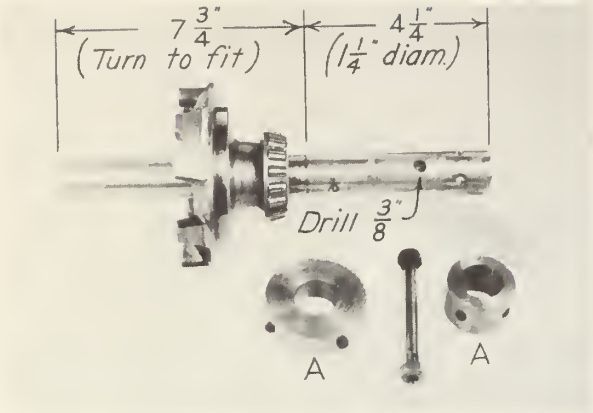


Fig. 3.--Countershaft machining dimensions. The location of the 3/8-inch drilled hole will be as required to bolt the hub of the large sprocket to the shaft. The bore of set collars A is 1-1/4 inch; the outside dimensions are not important.

Fig. 4.--Countershaft welded into half of the differential case at A.

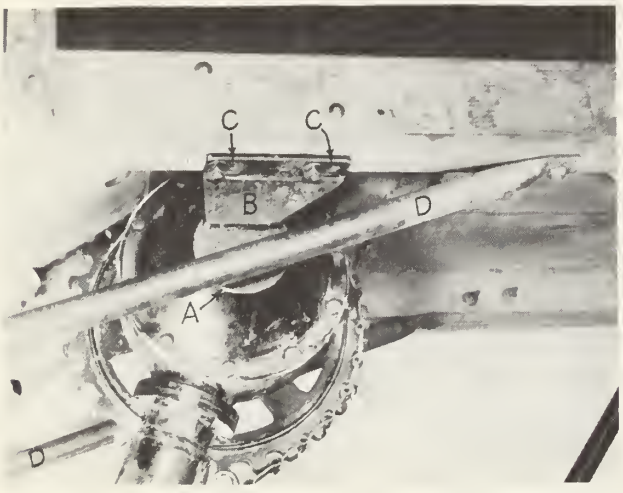


Fig. 5.--Axle housing cut off at A, and 1/2-inch steel plate welded across opening. B is 1/4 × 1-1/2 × 2-1/2 × 6 inch angle welded to the plate. The bolt holes C are slotted for chain adjustment. Platform braces D are 3-foot lengths of 1-inch iron pipe.

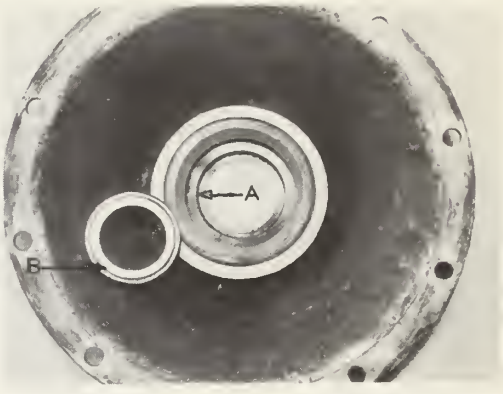


Fig. 6.--Differential housing cover plate, showing 1/2-inch plate counterbored at A, for grease retainer B (no. 50049 National).

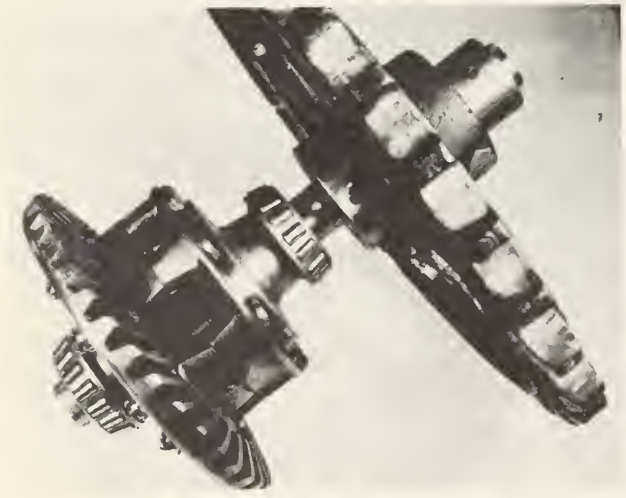


Fig. 7.--Countershaft assembly.

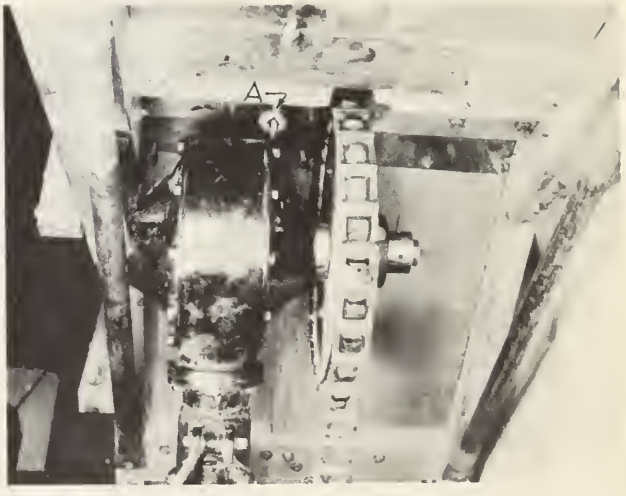


Fig. 8.--Rear view of countershaft in place. Eyebolt A, for tightening chain, is attached to an ear bolted to the side of the differential housing.

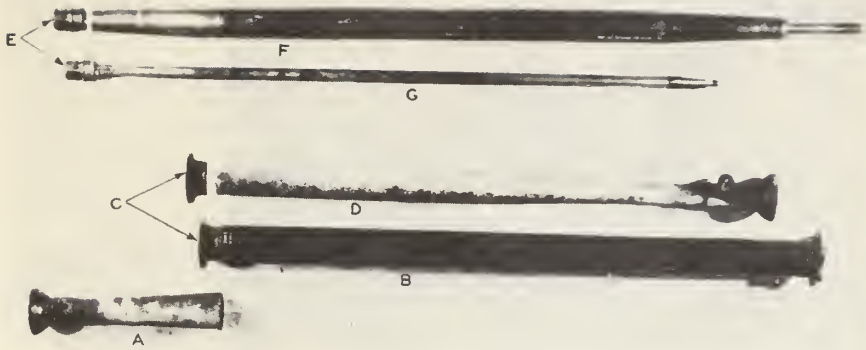


Fig. 9.--Torque tube and drive-shaft details: A and B, Ford V-8 torque tube; C and D, Ford model A torque tube; E and F, Ford V-8 drive shaft; G, Ford model A drive shaft.

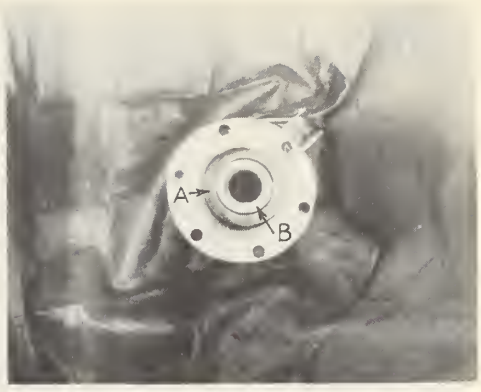


Fig. 10.--Model A Ford drive-shaft grease retainer. A, The 1/2-inch plate welded in place. B, National grease retainer no. 50045.

turn in the opposite direction to that of the V-8 wheels. Do not assemble the drive pinion and bearing until later.

The 27-tooth no. 62 chain sprocket wheel, figure 7, is bored to fit the countershaft. A 3/8-inch hole is drilled through the hub and the shaft for the 3/8-inch bolt that pins the sprocket to the shaft. Removal of this bolt permits the loader to be moved on the road without running the carrier chain. If the loader is to be trailed for long distances, the hub of the shaft should be fitted with a lubricated bearing. Shaft collars A, figure 3, hold the free-running sprocket in place. Figure 8 is a rear view of the countershaft.

Torque-Tube and Drive-Shaft Assembly

In figure 9, A is cut from B just above the radius-rod anchor lug. The flange end C is cut from D, 3 inches from the flange face (and later welded to B). A disk 1/2-inch thick is machined to fit into C, and counterbored to receive a no. 50045 National grease retainer, which is not pressed into place until the final assembling. The 1/2-inch plate is then welded into C, at the end opposite the flange (see A, fig. 10); E in figure 9 is cut from F. The cut end is machined, bored 1/2 inch, and welded as shown at E-G. Then C is cap-screwed to the model A differential housing. The drive pinion and bearing are now installed. Next, G is put in place, and the nut tightened lightly; B is cap-screwed into place on the V-8 differential housing, and G is put into B. The splined coupling, E, must slip over the splined end of the short drive shaft of the V-8. Level the V-8 rear axle with torque tube B in a horizontal position; also level the countershaft so that the V-8 rear axle and the countershaft are parallel. There should be 1/8 inch clearance between the ends of G and the short drive shaft of the V-8. Now C extends into B, and should be centered and welded in position. To disassemble, remove the drive-pinion nut; and remove the drive shaft, G, from the drive pinion. Replace all gaskets, press in grease retainers, reassemble, and fill both differential housings with transmission oil.

Bale Chute, Bracing, and Hitch Bars

The drawing on the last page shows the dimensions and details of the bale chute, platform, and bracing. The bale chute and platform are of wood, whereas the bracing and hitch bars are made from standard black pipe. Since the carrier chain slot is centered over the 27-tocth sprocket wheel, the bale chute is placed to the right of the center of the rear-axle assemblies.

Figure 11 shows brace anchor lugs welded to V-8 rear-axle housings. Figure 12 illustrates the lower end of the bale chute, showing runners, pickup chains, and carrier chain; these parts are seen from the underside in figure 13. Figure 14 shows the hitch bars and brackets attached to the loader, and figure 15 indicates how the hitch bars are attached to the truck.

The hitch bars will be of different lengths for different trucks. The hitch hooks are of the ball type, and the brackets (see D, fig. 15) into which they hook should be drilled so the ball will just pass through. This type of hook will not disengage while under load, but is readily removed when not under load.

The loader should be lined up with the truck for fitting the hitch bars. The loader is placed on the left side of the truck, with the right loader wheel a few inches in front of the left rear truck wheel (on most 1-1/2-ton trucks). Hitch bars and hooks of the type shown make a flexible attachment to the truck; hooking or unhooking takes only a few seconds, yet the truck can be backed or turned in any direction without interference from the loader.

Chain and Attachments

No. 62 detachable link chain, either malleable or of steel, is used to pick up and carry the bales. Spikes or fingers, 1-1/2 inches high, are inserted every seventh link on the large carrier chain, and every third link on the short

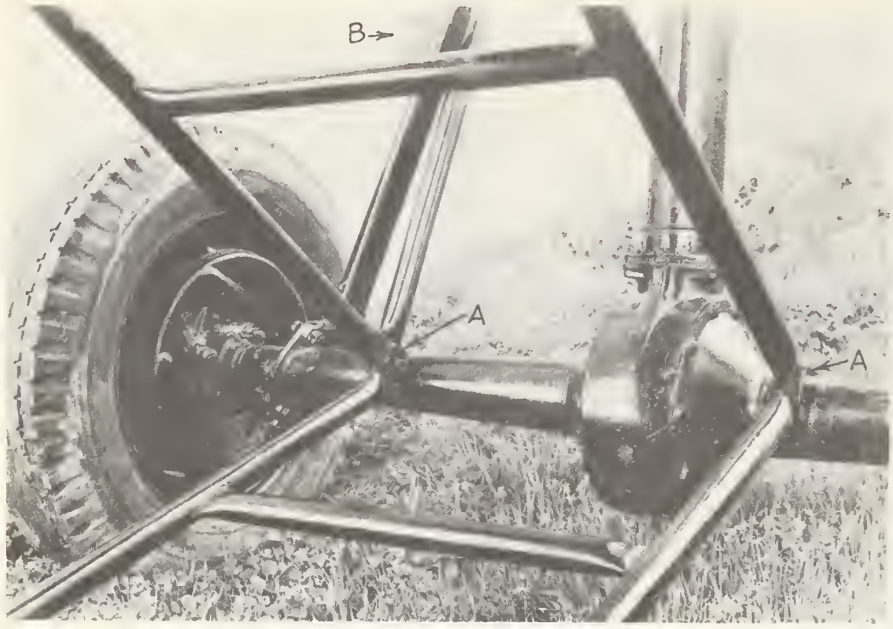


Fig. 11.--Braces attached to the rear axle. A, Anchor lugs welded on the rear-axle housing to attach chute and platform braces. B, Rear spreader-bar bracket on radius rod.

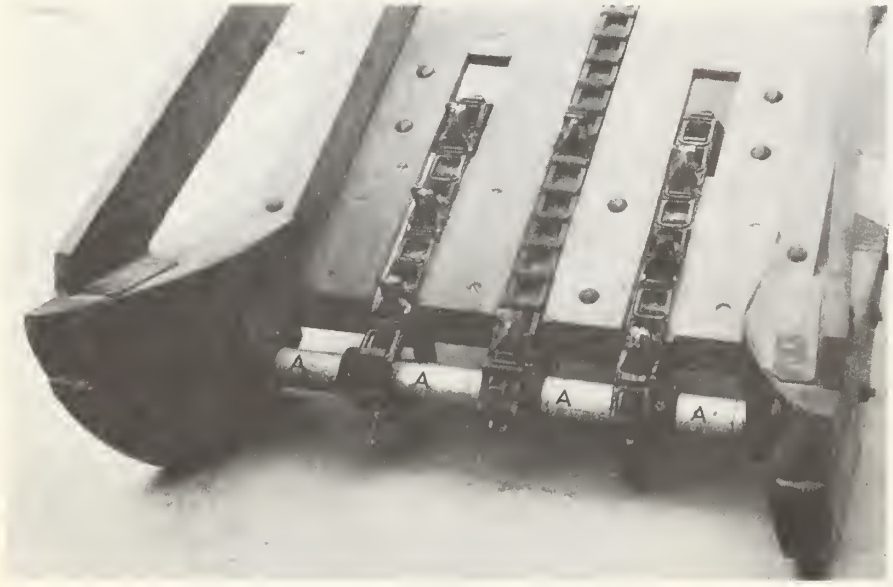


Fig. 12.--Lower end of the bale chute, showing runners, pickup chains, and carrier chain. A, Pieces of 1-1/4-inch iron pipe over 1-1/8-inch lower pickup shaft to prevent winding.

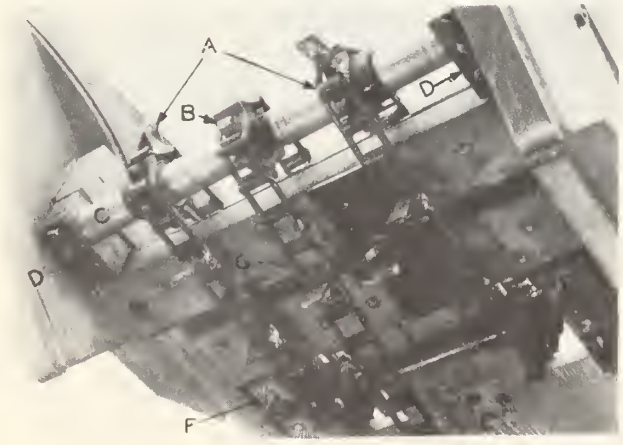


Fig. 13.--Lower end of the bale chute viewed from the underside. A, Pickup chains. B, Carrier chain. C, Lower pickup shaft. D, Lower pickup shaft bearings. E, Upper pickup shaft. F, Upper pickup shaft bearings slotted to tighten pickup chains. G, Lower bracket for tow bar.

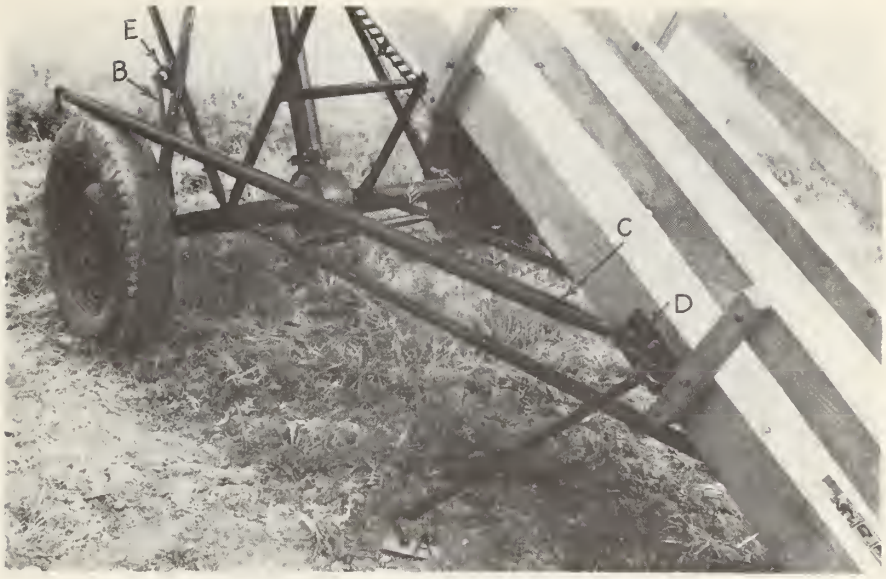


Fig. 14.--Hitch bars and brackets attached to the loader. A, Front spreader bar, 1-inch iron pipe. B, Rear spreader bar, 1-inch iron pipe. C, Push bar, 1-1/4-inch iron pipe, length 6 1/2 feet overall. D, Hitch-bar bracket on bale chute. E, Rear spreader-bar bracket on radius rod. The lengths of the spreader bars A and B are made to fit the truck, or they can be made adjustable as to length.

Fig. 15.--Hitch bars and brackets attached to the truck. A, Front spreader bar. B, Rear spreader bar. C, Push bar. D, Hitch-bar bracket on the truck sill. E, Eyebolt to hold the front spreader-bar hook.

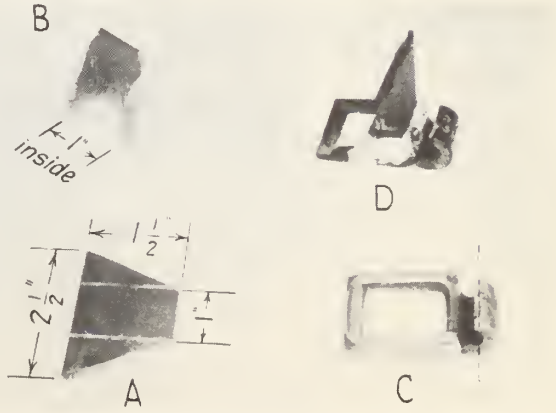


Fig. 16.--Homemade chain attachment: A, 1/8-inch mild-steel plate; B, plate A folded on white lines over 1 × 1 inch steel bar; C, no. 62 detachable chain link (grind off 1/16 inch of hook along dotted line); D, folded plate B brazed to chain link.

pickup chains. Standard no. 62 attachments, no. C-1, are satisfactory (if available). Forty-three attachments are required, equivalent to 6 feet of chain.

Figure 16 shows one way to make an attachment on a malleable link. The end of the hook is ground off before brazing, as indicated by the dotted line in illustration C, to give sufficient clearance for hooking the links together. Before brazing the entire set, try hooking the first attachment into a regular link to be sure they will go together easily.

Field Operation

The bale loader enables two people to load bales rapidly in the field; one drives the truck, and the other removes the bales from the loader platform and stacks them on the truck bed. No one is needed on the ground. The truck can be steered to pick up bales that are at some angle to the line of travel; but any bales at right angles to the windrow must be moved into line. Simple guide rods on the rear of the baler (fig. 17) will place the bales in line and on their bottom edges, the proper position for efficient use of the bale loader.

The loader can be towed as a semitrailer. The towbar (fig. 18) is inserted in two brackets on the underside of the bale chute (fig. 19) and then attached to the trailer hitch on the truck (fig. 20).

Fig. 17.--Bale guides lay the bales down on their bottom edge and in line with the windrow ready for the bale loader. This one is made from 16 feet of 3/4-inch pipe; it projects 6 feet back of the press.

Fig. 18.--Tow bar removed from the loader: A, 1-1/4-inch iron pipe, 6 feet long; B, part of 1-1/2-inch pipe coupling welded to the bar; C, other part of the pipe coupling fastened to the tow bar by a bolt.

Fig. 19.--Tow bar installed. A, Upper bracket. B, Lower bracket.

Fig. 20.--Loader being towed.

Bill of Materials

Parts:

1 Ford V-8 rear end with two wheels
1 Ford model A rear end
30 ft. no. 62 detachable link chain
6 ft. no. 62 C-1 attachment links
1 only, 27-tooth no. 62 sprocket wheel, 1-1/4" bore*
5 only, 6-tooth no. 62 sprocket wheels, 1-1/8" bore
1 National grease retainer no. 50045
1 National grease retainer no. 50049
2 only, 1-1/4" set collars
3 only, 5/16" × 5/16" × 2" keys
5 only, 5/16" × 3/8" Allen (safety) set screws
5 angle Zerk grease fittings

Lumber:

2 pcs. 2" × 6" — 14' S4S
1 pc. 2" × 6" — 4' S4S
1 pc. 2" × 4" — 12' S4S
2 pcs. 2" × 4" — 8' S4S
2 pcs. 2" × 12" — 2' (runners, oak preferred)
3 pcs. 1" × 4" — 12' S4S
2 pcs. 1" × 10" — 12' vertical-grain Douglas-fir†
1 pc. 1" × 10" — 8' vertical-grain Douglas-fir†
1 pc. 3/8" × 1-3/4" — 12' maple or oak flooring
1 pc. 2" × 4" — 2' maple (bearings)

Hardware:

72 only, 1/4" × 3" flathead (stove) bolts
12 only, 1/4" × 2-1/2" carriage bolts
14 only, 3/8" × 6" carriage bolts
12 only, 3/8" × 5" carriage bolts
30 only, 5/16" × 4" carriage bolts
1 only, 3/8" × 3" machine bolt
1 only, 3/8" × 4" machine bolt
4 only, 5/16" × 3" lag screws
4 only, 1/4" × 1-1/2" lag screws
7 doz. 1/4" cut washers
3 doz. 5/16" cut washers
2 doz. 3/8" cut washers

Steel:

1 pc. cold-rolled shafting, 1-1/4" × 12" (countershaft)
1 pc. cold-rolled shafting, 1-1/8" × 24" (lower pickup shaft)
1 pc. cold-rolled shafting, 1-1/8" × 18" (upper pickup shaft)
2 ft. 3/4" round mild steel (hooks on hitch bars)
2 pcs. 1/4" × 2" × 42" (runner shoes)
2 pcs. automobile main leaf, 30" long (guide arms)
1 pc. 2-1/2" × 2-1/2" × 6" angle (hitch-bar bracket on truck frames)
1 pc. 1-1/2" × 2-1/2" × 6" angle (bracket on model A housing)
1 pc. 3/8" × 12" round mild steel (eyebolt on model A housing)

Pipe (black iron):

14 ft. 1-1/4" (push bar, tow bar, and pickup shaft covers)
42 ft. 1" (braces and spreader bars)
10 ft. 1/2" (railing on platform)

Miscellaneous:

1/2 gallon paint

A few small pieces of scrap steel not specified, but available around a shop.

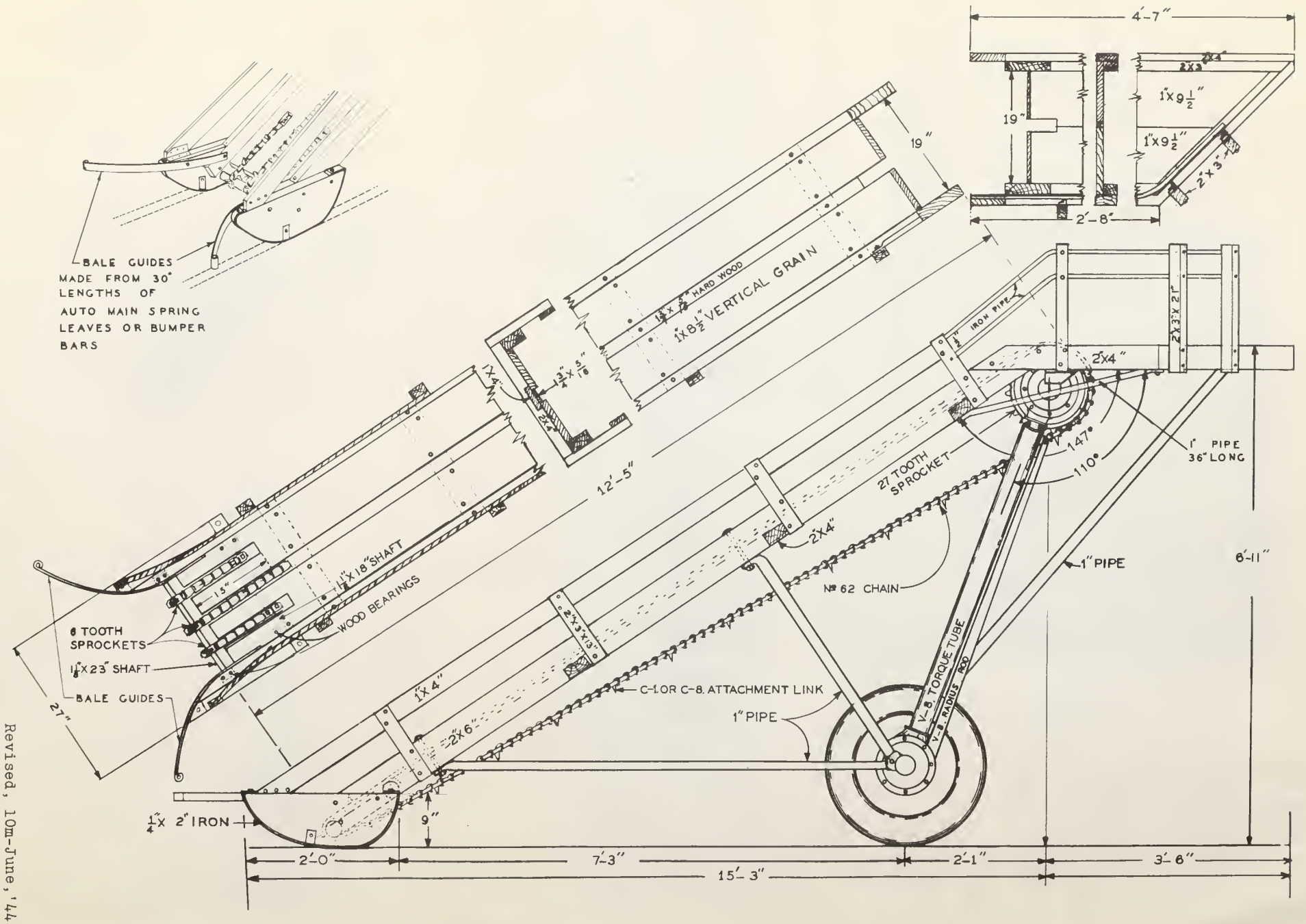
Cost:

The total cost of parts and materials should be under $90.00, assuming the price of the two automobile rear ends and wheels to be as much as $35.00.

---

*This sprocket may have 26 to 32 teeth, as available.

†For flooring for chute and platform; stepping or stair tread is good.



Revised, 10m-June, '44(642)